1.0 INTRODUCTION

The Schwerin Concaves Site (Site) is a former hard chromium electroplating facility located about four miles north of Highway 12 on Sapolil Road in Walla Walla County, Washington and is situated on a farm within a rural area (Figure 1). The Site has been identified by the Washington Department of Ecology's (Ecology's) Toxics Cleanup Program as an orphan site. This means that the potentially liable person(s) are either financially unable or unavailable to conduct remedial action in an adequate or timely manner at this site. Therefore, Ecology will utilize Model Toxics Control Act (MTCA) Chapter 70.105D RCW funds to complete site investigation in accordance with MTCA requirements.

Ecology has completed a State-Lead Remedial Investigation (RI) at the Site. The purpose of the RI is to collect, develop, and evaluate the nature and extent of releases of hazardous substances (as defined by RCW 70.105D.020(7)) from a Facility (as defined in RCW 70.105D.020(4)), and to gather the necessary data to support the Feasibility Study (FS). Information was collected, developed, and evaluated with the intent to provide for the completion of a FS and subsequent selection of a cleanup action under WAC 173-340-360.

2.0 BACKGROUND

Schwerin Concaves, Inc. (Schwerin) owned and operated a hard chromium electroplating facility on this property from the late 1970s to 2000. Ecology understands the facility was part of a wheat farming operation prior to its use as a plating facility. The farming operation continues to be present on other portions of the property. Schwerin electroplated internal farm combine components called concaves that remove husks from grain kernels. The concaves were brought to the facility and refurbished by a process that involved three main work areas: the cleaning station, plating station, and the wastewater treatment station. The wastewater treatment consisted of a multi-step process that included the following:

- Addition of ferrous sulfate from small "addition" tank. Water was circulated from wastewater treatment tank through small addition tank back to a wastewater tank.
- When hexavalent chromium concentrations reached zero according to colorimetric tests, calcium hydroxide was added to the wastewater via the addition tank.
- When trivalent chromium concentrations reached zero according to colorimetric tests, the treated water was drained into the holding tank.
- The water was allowed to sit in the holding tank so sludge and particulate could settle to the bottom. The sludge was removed and placed into a filter press in order to remove most of the water.
- Filter-pressed sludge was placed into wooden boxes for temporary storage.

- The sludge was loaded onto a heated conveyor system for drying. The dried sludge was packaged and shipped as hazardous waste to Arlington, Oregon.
- The treated wastewater was periodically transported to a temporary storage tank for disposal in the industrial park whose drains were connected to the Walla Walla wastewater treatment through the sewer lines.

The precision and reliability of testing equipment most likely allowed chromium concentrations above zero to remain in the treated water. Prior to 1988, the wastewater was pumped to a 10,000-gallon holding tank. The tank was located in a below-ground containment north of the plating shop. The treated wastewater was periodically pumped to an unlined settling pond in the self-propelled shed.

Ecology's Hazardous Waste Toxics Reduction Program completed several inspection and technical assistance visits to the facility between 1988 and 2000. Compliance investigations noted several hazardous waste management violations and practices that resulted in site contamination. These violations included improper treatment of sludge and wastewater, chemical and sludge storage, and disposal practices. The Schwerin Concaves Site was placed on the Washington State Hazardous Sites List in August 2000. In addition, a site hazard assessment (SHA) was completed which resulted in a site ranking of 2. This site's ranking, on a scale of one to five with one being the highest, is relative to all other Washington State sites assessed at this time. This ranking indicates that the site is considered to pose a very high assessed risk to human health and the environment from confirmed and suspected site contamination.

2.1 Hazardous Waste Compliance

The first Ecology site inspection was conducted in June 1988. Nine areas of non-compliance were noted by the Ecology hazardous waste inspectors and a follow-up compliance letter was sent to correct the areas of general non-compliance. Another site inspection was conducted in April 1989, and six additional violations were noted during the visit. A letter was sent from Ecology to Schwerin in July 1989 to correct the non-compliance issues.

A consultant was hired by Schwerin to provide environmental services. The consultant completed a contaminant report that identified two areas of contamination and addressed other cleanup issues including RCRA closure (Technico, 1989). Correspondence between Ecology and Schwerin continued regarding hazardous waste violations that included a closure plan, worker training, waste water treatment, and sludge disposal.

In July 1991, EPA conducted a RCRA facility assessment at the Site. The EPA assessment identified ten solid waste management units (SWMUs) and violations at the site. A draft order was completed by EPA but never issued.

Ecology completed a site inspection in January 1992 and noted 13 violations. A letter and follow-up inspection was conducted in May 1993. Eight violations were observed in the May 1993 inspection. Six site inspections were conducted from 1994 through 1999 with continued violations noted. In March 2000, Ecology issued an Enforcement Order to Schwerin to conduct a study at the Site to define the extent of soil and groundwater contamination. Schwerin did not conduct the study prior to Ecology levying a $221,000 penalty for the continued violations observed throughout the years. Given the financial condition of the business, Ecology elected not to pursue collection of the fine.

In addition to the violations noted by Ecology, the EPA conducted a criminal investigation regarding improper handling and storage of hazardous waste at the Site. The investigation led to criminal charges and the plating shop was closed. As part of the criminal settlement, the plating shop interior and its contents were dismantled and disposed in accordance with state and federal regulations. Additional information on Hazardous Waste compliance can be found in the Hazardous Waste Toxics Reduction administrative file at Ecology's Eastern Regional Office.

3.0 PHYSICAL SETTING

The Schwerin Concaves Site is located about four miles north of Highway 12 on Sapolil Road in Walla Walla County, Washington. The property is located in Section 31, Township 8 North, Range 37 East, Willamette Meridian at 46^{o} 04' 08" north latitude and 118^{o} 21' 20" west longitude, and is situated on a farm within a rural area (Figure 1). Topographic map coverage of the Site and Site vicinity is provided by the Buroker Quadrangle, U.S. Geological Survey, 7.5 minute series dated 1966. The Site elevation is about 1220 feet above sea level using the National Geodetic Vertical Datum (NGVD) of 1929.

The Site is located along the north bank of Dry Creek, which is a tributary to the Walla Walla River. The immediate vicinity is rural and sparsely populated. Agricultural fields bound the Site on the north, west and east sides with Dry Creek forming the southern border. The Site is relatively flat with the topographic relief provided by the stream channel of Dry Creek. The topographic gradient is one percent or less from east to west across the Site. The elevation change ranges from 1224 feet at monitoring well MW-4 to 1218 feet at monitoring well MW-3 (Figure 2). The general land slope steepens to the north and south of the Site and drains across the Site and toward Dry Creek. The property is unpaved and surface water will pond in some areas and generally drains to the south toward the creek.

The plating operation was housed mainly in one large building with five auxiliary buildings that were used to store products and waste. A storage tank housed inside a subterranean covered shed was located to the north of the plating shop. The auxiliary buildings include an office/maintenance shop, self-propelled shed, long farm shed, a storage shed, and barn. A residence and garage are located west of the long farm shed (Figure 2).

3.1 Regional Geology

As described above, the site is situated near the Walla Walla River Valley. Geologic materials in the area are described as alluvial and glacial deposits. Generally, the alluvial deposits consist of unconsolidated silt, sand, and gravel valley fill. The glacial deposits of Pleistocene age are lacustrine in nature and include fine-grained sand and silt with some gravel.

The oldest, thickest and most extensive valley fill unit of these deposits consists of the "old clay", up to 500 feet or more in thickness, which partially fills the Walla Walla Basin. The "old clay" is interfingered with the "old gravel". The "old gravel" is composed largely of well-rounded, pebble, cobble, and boulder gravel derived principally of basaltic material. The gravel is typically set in a matrix of sandy and silty material. In some cases considerable calcareous cement is present. Successively younger deposits of Pleistocene age, known as the Palouse Formation, Touchet Beds, and recent alluvium overlie the "old gravel" and "old clay" in some areas, as well as the basalt.

The "old gravel" extends approximately from the foot of the Blue Mountains located east of the Site to Dry Creek near Buroker. It formed generally by the deposition of coalescent alluvial fans (Newcombe, 1965). The upper portion of this alluvial surface was covered by later unconsolidated materials and forms the present physiographic surface in the upper part of the valley; the unconsolidated deposits that overlie the original fan surface in the Sapolil area are comprised of silty clays possibly of the Palouse Formation. The lower part of the valley is principally covered with glaciofluvial and recent alluvial deposits.

The unconsolidated sediments overlie rocks of the Columbia River Basalt Supergroup. These basalt flows are grouped into different units. Each unit has varying thickness and depths throughout the Columbia Plateau and contains numerous individual flows. The basalt dips westward from the Blue Mountains, southward down the "Touchet Slope", northward from the Horse Heaven ridge, and eastward from a divide ridge in the lower valley. These dips converge into a synclinal trough whose bedrock surface extends below sea level in at least two places west of Walla Walla. This trough defines a hydrologic sub basin of the Columbia Plateau known as the Walla Walla Basin.

The Columbia River Basalt Supergroup formations found in the area include the Saddle Mountains Basalt that overlies the Wanapum Basalt. The Wanapum overlies the Grande Ronde. Based on a review of well logs, a majority of the domestic and municipal supply wells in the area are completed in the Wanapum Basalt.

3.1.1 Site Geology

The site geologic interpretation is made from split spoon samples and drill cuttings collected from the monitoring wells installed on-site, temporary well point samples, and excavation activities (Figure 2). The upper soil profile consists of light brown, dry medium dense, sandy silt. The sand is mostly fine-grained and the silt is non-plastic to slightly plastic. An ash layer was encountered in one boring from about 11 to 13 feet below ground surface (bgs). The sandy silt overlies sandy gravel with silt (5-15%) or gravelly sand. The contact of the two soil layers varies from 12 feet bgs in monitoring wells MW-4 and MW-5 to over 20 feet bgs in wells MW-7, 8, and 9. The gravel becomes sandier and less silty with depth. The site geology appears to correspond with the regional geology since the upper soil profile appears similar to loess of the Palouse Formation and the gravelly zone correlates to the "old gravel."

Bedrock was encountered in five of the nine monitoring well borings. The surface of the basalt bedrock was encountered 35 to 39 feet bgs and was closer to surface in wells MW-4 and MW-5, which are closest in proximity to Dry Creek. Based on the drilling, the basalt appears to form a relatively flat surface that gently dips away from Dry Creek. Boring logs and geologic cross sections are presented in Appendix A.

3.2 Regional Hydrogeology

Groundwater occurrences in the Walla Walla Basin are developed in basalt bedrock, the "Old Gravels;" and the recent alluvium overlying the "old gravels," which includes loess soil and glaciofluvial sands and gravels. The majority of groundwater is used for irrigation with the remainder used for domestic and industrial purposes.

The regional groundwater flow direction in the gravel aquifer is west with a southern or northern flow component relative to the main stem of the Walla Walla River. The regional groundwater flow direction in the basalt aquifer is west with a southerly flow from the Touchet River toward the Walla Walla River and a northerly flow from Oregon toward the Walla Walla River.

3.2.1 Site Hydrogeology

The Site hydrogeology is based on the nine monitoring wells that Ecology installed at the Site. Groundwater was encountered at varying depths based on the proximity to Dry Creek and the occurrence of bedrock. As shown in Figure 2, monitoring wells MW-1, MW-2, MW-3, and MW-7 encountered groundwater about 40 feet bgs. Monitoring wells MW-4, MW-5, MW-6, MW-8, and MW-9 encountered groundwater at approximately 30 feet bgs. Groundwater occurs in brown, gravelly sand or sandy gravel with silt.

Static water levels after monitoring well construction range from 17 feet bgs in MW-4 to 33 feet bgs in MW-2. Based on water level elevations, bedrock significantly controls the water table surface. Groundwater flows away from the creek to the northeast. The water levels and flow direction appear to be directly influenced by Dry Creek and bedrock. Due to a thickening of the gravel aquifer, monitoring wells MW-1, MW-2, MW-3, and MW-7 did not encounter bedrock. Water level measurements are presented in Table 1.

4.0 REMEDIAL INVESTIGATION

The remedial investigation (RI) scope of work was developed based on the available chemical and physical data and the site hydrogeologic conditions. The scope of work objectives were intended to characterize the Schwerin Concaves Site in order to provide sufficient information for a Feasibility Study (FS) and eventual cleanup. The purpose of the RI is to evaluate the physical and chemical characteristics associated with contaminants at the site, and determine their potential threat to human health and the environment.

4.1 Soil Investigation

Soil borings were used to assess the subsurface soil conditions. The drilling program was designed to characterize the nature, lateral and vertical extent, and approximate volume of contaminated soil. The borings were logged on-site and identified according to the Unified Soil Classification System (USCS).

Boring locations were selected to provide site coverage of known and potential soil contaminant locations, and provide a preliminary characterization of site conditions. Based on the distinct coloration typically associated with chromium contamination, it was anticipated that Ecology would be able to visually distinguish the existence of affected soil and its contact with clean or less impacted soil.

Soil samples were collected for lithologic description, field screening, and archiving. The samples were collected using a split-spoon sampler driven with a 140-pound hammer through a freefall of 30-inches per blow. Sample retrieval was very difficult with refusal conditions typical below 15 to 20 feet. Limited sample recovery resulted in minimal sample being available for observation and testing. Attempts at collecting samples were made at five foot intervals or apparent changes in geologic conditions. Visual observation of drill cuttings and drilling rate assisted in determining sample depths outside the five-foot interval sampling depths.

4.1.1 Soil Borings

Ecology executed a public works contract for the drilling services with Environmental West of Spokane, Washington. Drilling and field work at the Site was initiated in October 2000. A Mobile B-80 drill equipped with a six-inch Tubex system and auxiliary air compressor was used to complete the borings. Each of the soil borings were completed as monitoring wells. Four borings/monitoring wells were completed at the Site during the October 2000 effort.

The boring locations were selected to provide an initial insight into groundwater quality near known and possible contaminant sources (Figure 2). The location for monitoring well MW-1 was selected to provide an assumed upgradient well for the Site. Monitoring well MW-2 was located in a perceived downgradient location of the plating shop. Monitoring well MW-3 was placed downgradient of the maintenance shop and MW-4 was located in a presumed downgradient location of the self-propelled shed. Monitoring well MW-4 was the only boring that encountered bedrock during this phase of work.

In 2001, Ecology completed a second phase of drilling and field work at the Site. The work was designed to further define the soil and groundwater contamination at the Site. Field work was initiated in December 2001. Environmental West of Spokane, Washington provided drilling services with similar equipment as the initial investigation. As shown on Figure 5, five additional monitoring wells were completed at the Site with the Tubex drilling system. Monitoring well MW-5 was placed between MW-4 and Dry Creek in order to assess water quality near the creek. Monitoring well MW-8 was located east of the self-propelled shed to monitor groundwater conditions east of the shed as MW-4 does on the west side of the shed. Monitoring wells MW-6 and MW-9 were placed near the southwest and southeast corners of the plating shop to assess the presence of bedrock and groundwater conditions between the identified contamination sources. Monitoring well MW-7 was placed near the northeast corner of the plating shop in the proximity of the wastewater holding tank.

Of the five wells installed in 2001, four encountered bedrock during their completion. MW-7 did not to encounter bedrock during drilling. The bedrock that was encountered suggested the basalt has a relatively flat profile with a gentle slope away from the creek.

4.1.2 Geoprobe Borings

Based on the information generated from the soil borings and the difficulty in sample retrieval, additional exploration was needed to further assess the subsurface. The subsurface exploration was designed to provide additional lithologic information as well assist in developing a bedrock profile near the self-propelled shed.

In October 2001, a geoprobe drilling program was initiated to assess the subsurface. The direct push technology provides a quick, efficient drilling method that advances a 1.5-inch inside diameter steel sample barrel into the subsurface in four-foot intervals. The sampler is advanced utilizing hydraulic pressure and a hammer. The sample barrel is lined with clear PVC tubes and is advanced into the soil. The clear liners allow for full observation of a relatively undisturbed sample that is collected from various depths. Nine borings were completed with the Geoprobe and were mostly concentrated around the self-propelled shed (Figure 2). Two geoprobe borings were completed in the area near MW-2.

The geoprobe borings were designated TB-1 through TB-9 and were completed to varying depths based on refusal drilling conditions. In general depths ranged from 16 to 23 feet bgs. TB-9, which was located near MW-2, was advanced to 29 feet bgs. Soil samples were collected for laboratory analysis from probe borings TB-7 and TB-9. Groundwater samples were collected from four of the temporary borings. The temporary borings that were sampled for groundwater included TB-1, TB-4, TB-7, and TB-9.

4.2 Groundwater Investigation

As a precautionary step, Ecology sampled domestic water wells in the area. An inside faucet or outside spigot was used to retrieve the sample. As described above, two separate field efforts were conducted to install a network of nine monitoring wells, MW-1 through MW-9, to evaluate Site groundwater. Samples have been collected on a quarterly basis since the wells have been installed. As identified above, temporary borings were also used to monitor groundwater. The samples collected from the temporary wells provided a brief snapshot of perched water quality at the selected locations. Data collected from the wells were used to evaluate groundwater chemistry and elevations to determine flow direction and aquifer characteristics.

4.2.1 Domestic Wells

Ecology conducted a review of adjacent landowners and well logs. A one-mile radius was used to locate domestic wells that could be potentially affected by contaminants for sampling locations and eight domestic wells were identified for sampling. The wells are completed at varying depths in basalt bedrock. Landowners were contacted and permission was granted prior to the May 2000 sampling. The samples were collected and submitted to Ecology's Manchester Laboratory for total metals analysis. Samples were collected from an exterior faucet where the water was allowed to run for 3-5 minutes prior to sampling. Sample results indicated that the metal concentrations were below laboratory detection limits, Washington Department of Health Drinking Water Standards, or MTCA Method A cleanup levels.

4.2.2 Monitoring Wells

The monitoring wells have been sampled on a quarterly basis at the Site. A quarterly sampling round was not completed during the interim action activities. The samples were submitted to the analytical laboratory for total metal analysis. The groundwater analytical program was based on knowledge of the Site operations and of similar industries.

Groundwater samples were collected from the monitoring wells using a submersible pump or a disposable bailer. Alconox detergent was used to decontaminate the pump between each sampling event.

Groundwater elevations were measured prior to each sampling event to the nearest 0.01 foot with an electronic water level indicator. To insure consistent data collection, water levels were measured to the reference point on the north side of the well casing. Monthly water level elevation measurements were conducted between January 2002 and August 2005. Water level measurements are tabulated in Table 1.

Parameters such as pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential (ORP) were measured in the field with the appropriate electronic instrumentation. A groundwater sample was collected after three well volumes had been purged. The parameters were measured during well purging and recorded prior to sampling. Samples were placed into laboratory-provided jars, placed in coolers with ice and submitted to the analytical laboratory via an overnight carrier.

4.2.3 Temporary Well Points

Water samples were collected from four temporary Geoprobe borings by allowing perched groundwater to accumulate at the boring terminus and collecting the accumulated groundwater with a peristaltic pump. New tubing was used at each sampling point to purge three well volumes of groundwater from the boring into a five-gallon bucket. Wells that were purged dry were allowed to recover prior to sampling. Since the temporary borings were not developed as monitoring wells to produce relatively sediment-free water, the samples were very silty. Since metals can be sediment particle adherent, the turbidity or suspended sediment may result in biased high sample results.

4.2.4 Piezometers

In October 2001, seven piezometers were installed by Ecology staff along Dry Creek and were designated as P1 through P7. The purpose of the installation was to assess the hydraulic interaction between shallow groundwater and Dry Creek. The piezometers were constructed of ½-inch diameter steel pipe with a crimped end. The crimped end was perforated with 1/8-inch diameter holes to allow for water infiltration. The end also served as a drive point for piezometer installation. The upper end of the piezometer was threaded and fitted with a cap for drive installation. The piezometers were located immediately adjacent to or in the creek and were installed using a fence post driver. Generally, the piezometers were hand driven to three to four feet bgs where refusal conditions were encountered. Following installation, the piezometers were developed using a hand pump.

Water levels were measured within the piezometer to the top of casing and from the casing top to the creek surface. The piezometers provide an indication of inferred flow relationships between Dry Creek and groundwater. The difference in elevation provides an indication of flow direction. When the creek elevation is higher than the water level in the piezometer the inferred flow direction is from the creek to groundwater. Likewise, when the water level within the piezometer is higher than the creek surface, the inferred flow direction is from groundwater to the creek.

Water level measurements were made from October 2001 to January 2003. These measurements indicated the creek recharges the shallow aquifer throughout most of the year at the majority of monitoring points. Piezometer P1 demonstrated an inferred flow direction from groundwater toward the creek. At times the creek and groundwater elevations were equivalent suggesting a parallel flow path between the creek and groundwater. These equivalent elevations occurred mostly during the late fall and early winter.

4.3 Seismic Survey

Ecology subcontracted with Aquila Geosciences, Inc. for geophysical services to be completed at the Site. A seismic refraction survey was completed at the Site in January 2002, with the purpose of determining bedrock depth at various locations since the bedrock profile developed from monitoring wells was incomplete. As shown as figure 6 in Appendix B, the survey consisted of five seismic refraction lines. Two of the five lines were completed in a west - east orientation and were 460 feet in length. Two of the lines were completed in a north - south orientation and were 460 feet and 220 feet in length, respectively. The remaining seismic line was oriented northwest - southeast and was 220 feet in length.

A Geometrics S-24 Engineering Seismograph connected with 10 hertz vertical component geophones was used to acquire data. The geophones were set at a 20 foot spacing interval. A twelve-pound hammer contacted against an aluminum plate provided the energy source necessary for data acquisition. The Generalized Reciprocal Method (GRM) was used to process and interpret data. Based on boring log information, the five seismic lines were interpreted as three layer cases. Intercept velocities were used to determine the depths of the two soil layers while the GRM velocity function was used to determine the depth to basalt bedrock. The seismic survey report is included as Appendix B.

The depth to bedrock calculated from the seismic survey corresponded with monitoring well information and in areas where the lines crossed. The bedrock depths ranged from 21 feet bgs to 70 feet bgs. The bedrock profile suggests that an elongated depression or trough feature trending generally west to east is positioned to the north of the shop operations north of monitoring well MW-2 (Figure 7, Appendix B).

4.4 Civil Survey

Following completion of the field activities, Ecology contracted with Tomkins Land Surveyors of Walla Walla, Washington to survey the monitoring wells, geoprobe locations, piezometers and seismic lines at the Site. The surveying was performed by a Washington State licensed professional surveyor and was conducted to determine relative locations and mean sea level elevations. Facility appurtenances were surveyed as appropriate to describe and map potential contaminant sources and sample collection locations. The survey was accurate to within 0.02 feet horizontally and vertically.

5.0 LABORATORY RESULTS

Soil and groundwater samples were analyzed at North Creek Analytical Laboratory which is Washington State certified. The analytical program was based on metal constituents typically used in chrome plating operations. The metals analyzed included arsenic, cadmium, chromium, hexavalent chromium, lead, and zinc. As a precautionary measure, groundwater was also analyzed for volatile organic compounds. Analysis for volatile organic compounds in soil was not conducted since the photo-ionization detector

(PID) field instrumentation did not indicate the presence of volatile organic vapors. Soil and groundwater samples were collected in laboratory provided jars, placed in coolers with ice, and submitted for analysis. North Creek Analytical was used because hexavalent chromium analysis in groundwater has a maximum 24-hour holding period that could not be met in-house.

5.1 Initial Investigation

The initial investigation completed in November 2000 included soil samples collected from monitoring well borings and groundwater samples from the four completed wells. As described in Section 4.1, sample retrieval was difficult; therefore, one soil sample near the soil/water interface was collected from each downgradient monitoring well. The soil samples were analyzed for total metals (Method 6000/7000 series) as arsenic, cadmium, chromium, lead, and zinc and volatile organic compounds (VOCs-Method 8260). Total metal results indicated sample concentrations were below MTCA Method A cleanup levels. VOC analyses showed sample concentrations were below detectable limits.

Groundwater samples were collected from the year 2000 installed wells designated as MW-1, MW-2, MW-3, and MW-4 and were analyzed for total metals as arsenic, cadmium, chromium, lead, zinc, hexavalent chromium, and volatile organic compounds. Samples MW-1, MW-2 and MW-4 indicated the presence of total chromium above Method A levels. Based on the analyses, the chromium was mostly in the hexavalent chromium form instead of the trivalent form. For screening purposes, groundwater laboratory results were compared to MTCA Method A cleanup levels. A summary of results are presented in Table 2.

5.2 Geoprobe Borings

During the geoprobe investigation, three soil samples and four groundwater samples were submitted for total metal and hexavalent chromium analysis. Soil samples were collected from probe boring TB-7 at 15 feet and 20 feet bgs near the soil/water interface. Probe TB-9 was sampled at 29 feet bgs. The groundwater encountered by the Geoprobe borings appeared to be perched on very dense soil that occurred at varying depths at the Site. Soil samples were analyzed for total arsenic, barium, chromium, hexavalent chromium, lead, mercury, selenium, and silver. Soil samples were below Method A cleanup levels.

Groundwater was collected from the temporary borings and analyzed for total arsenic, barium, chromium, hexavalent chromium, lead, mercury, selenium, and silver. Chromium and lead concentrations exceeded Method A cleanup levels in each of the temporary borings. The samples were very turbid and contained large amounts of sediment that may have contributed to the high metal concentrations.

5.3 Additional Groundwater Investigation

The five additional monitoring wells completed in December 2001, were designated Mw-5 through MW-9. The wells were first sampled in the scheduled quarterly sampling event in February 2002. Based on the limited soil sample retrieval, soil samples were not submitted for analysis. Samples were analyzed for total metals as arsenic, cadmium, chromium, lead, zinc, and hexavalent chromium. Samples MW-6, MW-7, and MW-9 indicated the presence of total chromium above Method A levels. Based on the analyses, the chromium was mostly in the hexavalent chromium form. The laboratory data sheets and data validation package are presented as Appendix C.

6.0 INTERIM ACTION

During remedial investigation (RI) activities, two suspected areas of contamination were confirmed. These areas, identified as the plating shop and the self-propelled shed, are believed to be the primary sources for groundwater contamination. Ecology conducted cleanup activities as an interim action because there was an immediate threat to human health and the environment in affected areas. The interim action was intended to provide rapid source control measures and limit groundwater contamination. Given the limited ability to retrieve subsurface characterization samples with a drill, Ecology believed that excavating the soil in the known contaminated areas was the most efficient use of funds. Ecology created a bid and specification package for excavation and disposal services. Aspen Environmental Ltd. of Mukilteo, Washington was the successful bidder for the remediation services.

A project kick-off meeting was held on-site on November 24, 2002. Prior to the interim action, two soil samples had been collected and analyzed from the self-propelled area to determine if the soil designated as dangerous waste. The soil did designate as dangerous waste by failure of the toxicity characteristics leaching procedure (TCLP) for chromium with concentrations of 30.7 and 160 parts per million (ppm) and thus was listed as D007 waste. Samples had not been retrieved from the plating shop area since the concrete access to the shop was needed for plating equipment removal. A portion of the soil in the plating shop area was assumed to designate as dangerous waste as well.

6.1 Self-Propelled Shed

Aspen Environmental mobilized to the site and began work on December 10, 2002 in the self-propelled shed area. The self-propelled shed dimensions are about 20 feet, west to east, by 30 feet, north to south. Prior to starting removal work, the structure was physically removed to allow access to the earthen floor and surrounding soils. The area was divided into six-10 foot by 10 foot grids to provide for sample location control during remediation.

The grids were designated SP1 through SP6, starting at the southeast corner and increasing in number in a clockwise direction (Figure 3). Test pits were excavated to about four feet below ground surface (bgs) in each of the grids to assess the depth that the soil no longer designated as dangerous waste. Samples were collected and submitted for chromium and lead analysis by TCLP methods. Sample results indicated that the soil below four feet did not designate as dangerous waste and could be disposed at a subtitle D landfill. Given the leachable quantities of chromium in the soil, additional stabilization was required before final disposal.

The self-propelled shed excavation extended beyond the original footprint of 20 feet by 30 feet. The final excavation limits were about 46 feet, west to east, and 35 feet, north to south, to an overall depth of 12 feet. The excavation was expanded beyond the original footprint because contamination was observed beyond the configuration and the necessary slope layback for the excavation depth. Approximately 750 tons of dangerous waste soils from the upper four feet of the self-propelled shed area were disposed at the Waste Management facility in Arlington, Oregon. Approximately 1,200 tons of contaminated soil that did not designate as dangerous waste were removed and transported to the Subtitle D Rabanco Regional Landfill in Roosevelt, Washington for disposal.

Grid sizes were expanded to accommodate the new excavation configuration. Soil samples were collected from the grid to assess and confirm the efficacy of the remediation. One sample was collected from the grid sidewall and one sample was collected from the grid bottom. In the case where a grid had two sidewalls, a sample was collected from each grid sidewall. Soil sample results indicated the soil at the margins of the excavation were below Method A removal cleanup levels for the site established at 19 milligrams per kilogram (mg/kg).

6.2 Plating Shop

The plating shop exterior consisted of a concrete slab apron and the partially buried polyurethane tank that was used for wastewater storage and treatment. The tank was situated inside a concrete masonry unit (CMU) secondary containment structure with a roof. The roof and tank were removed from the area by the owner prior to field work.

Similar to the self-propelled shed, the plating shop exterior was separated into a grid. The grid, which included the partially buried tank, was divided into four-10 foot by 10 foot grids to provide for sample location control. Initial soil samples collected from below the concrete pad within the grid suggested that the soil did not designate as dangerous waste. However, samples beneath and adjacent to the buried tank were not collected in the initial screening. During the secondary containment demolition, the CMU and adjacent soil was observed to be stained and discolored. Soil sample results indicated the soil designated as dangerous waste based on chromium TCLP concentrations of 5.45 ppm. The soil and stained concrete were sent to Arlington, Oregon for disposal as dangerous waste. About 892 tons of dangerous waste soils were removed from the plating shop area.

The visibly discolored soil in the plating shop area dictated that the original grid configuration be expanded. The grid was expanded to include two additional sections to the west where the concrete apron and entrance to the shop was located. As shown in figure 8, the final dimensions for the plating shop excavation were 42 feet, west to east, and 28 feet, north to south. The excavation depth varied from six feet deep along the western and northern portions and up to 19 feet below ground surface near the building.

Soil samples were collected from the grid to assess and confirm the efficacy of the remediation. One sample was collected from the grid sidewall and one sample was collected from the grid bottom. In the case where a grid had two sidewalls, a sample was collected from each grid sidewall. Samples results indicated the excavation soil were below Method A removal cleanup levels for the site.

7.0 DISCUSSIONS AND CONCLUSIONS

Based on the confirmation soil samples collected during the interim action, the contaminated soil was removed in the self-propelled shed and plating shop exterior areas at the Site. The soil was disposed at the appropriate permitted facilities based on the soil designation as either dangerous waste or contaminated soil. Additional soil removal in these areas does not appear to be warranted at this time.

Groundwater contamination continues to be present at the Site at concentrations well above cleanup levels. Using Method A cleanup levels as a preliminary screening tool, seven of the nine wells currently exceed the Method A levels of 50 parts per billion for total chromium. Method A cleanup levels were used to evaluate groundwater conditions since a single contaminant has been identified in a relative routine cleanup scenario and Method A cleanup levels are considered protective of human health and the environment.

Based on the monitoring well configuration and the groundwater contamination, it appears that releases from the two identified source have been distributed in the direction of groundwater flow. The contamination distribution in groundwater indicates the contamination is transported from the two identified source areas along multi-directional flow paths. The flow paths are created from groundwater elevations that are influenced by Dry Creek. In the area of monitoring well MW-8, groundwater flows north toward MW-6 and northeast toward MW-1. In addition, groundwater near MW-7 is at a higher elevation than adjacent wells MW-1 and MW-2 resulting in groundwater mounding near MW-7 and flowing west and east away from MW-7. The high contaminant concentration values in MW-7 appear to distribute and diminish as indicated by concentrations observed in MW-1 and MW-2, with higher concentrations in MW-2.
A declining trend has been observed in the high contamination monitoring wells. Additional groundwater monitoring will be required to further assess the efficacy of the interim action. A feasibility study (FS) will be prepared to evaluate different alternatives to address groundwater contamination.

The two areas where plating activities and waste storage occurred were identified and soil removal activities completed. An investigation of the plating shop interior has not been conducted. Given the nature of plating operations and evidence of historic releases associated with operations, the plating shop interior represents a potential source area for soil and groundwater contamination. Further investigation may be warranted.